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DIVISION OF MYCOLOGY AND DISEASE SURVEY

Vol. XXI Number 15

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IN THIS ISSUE

Geo. F. Weber, page 282, reports cabbage yellows and verticillium wilt of tomatoes from Florida for the first time.

Vegetable diseases in northern Ohio this year are reported by J. D. Wilson, page 282.

Downy mildew and blast of onion have been very destructive in both Massachusetts and New York, according to O. C. Boyd and A. G. Newhall, respectively, page 283.

O. C. Boyd reports the incidence of vegetable diseases in Massachusetts, page 284.

Reports on fruit diseases, page 285, include apple scab in Massachusetts and New York, and strawberry dwarf in Massachusetts.

Tobacco downy mildew was found in several additional fields in Massachusetts, page 286, according to O. C. Boyd, who reports other tobacco diseases.

Some notes on tobacco diseases in Canada, pages 287 to 291, by L. H. Koch and others, are quoted from The Lighter.

O. P. Owens reports that oak leaf blister has been unusually prevalent in North Carolina during the past two years, page 291.

The Dutch elm disease has been found in another location in Ohio, at Athens, page 292.

Brief notes on plant diseases, page 292, include reports on stem rust in the spring wheat region, bacterial wilt of sweet corn in New York, and diseases of trees and ornamentals in Massachusetts.

July weather, page 293.

TWO NEW FUNGOUS DISEASES OF VEGETABLES IN FLORIDA

George F. Weber

Two plant diseases, of economic importance elsewhere in the United States, were found for the first time this year affecting crop plants grown extensively in Florida.

Cabbage yellows, a destructive disease caused by Fusarium conglutinans Woll., was found in the winter crop in the vicinity of Bartow, Florida, scattered in several fields aggregating over 100 acres, ranging from 5 to 100 percent infected plants. The loss on this acreage was more than usual, probably due to exceptionally high temperatures and lack of moisture which prevailed during the fall-growing season. Diagnosis of the disease was made by isolating the fungus from diseased plants, infesting sterilized sick soil with cultures of it and setting cabbage seedlings in this soil and unsterilized sick soil from the field. Susceptible plants developed typical yellows symptoms in both the naturally and artificially infested soils, while resistant plants remained healthy. The disease was probably brought into this State on plants sent from Racine, Wisconsin to Florida for winter seed production about 1920.

A wilt disease of tomatoes first detected by David G. A. Kelbert and sent to Gainesville for identification was found to be caused by the fungus Verticillium albo-atrum Reinke. and Berth. It was found in Manatee County, and a thorough survey in April, when the plants were about half grown, showed it to be causing losses, augmented by water injury, up to 100 percent of the plantings in fields over an area approximately ten miles in diameter. Tomatoes have been successively grown year after year for a quarter of a century in this area, yet this disease, if present, has not been previously identified in the locality or on vegetable crops elsewhere in the State. In certain parts of the United States this parasite causes extensive losses on a number of the cultivated vegetable crops. Tomatoes grown in soil artificially inoculated with the Verticillium isolated from wilted plants became diseased; and plants artificially inoculated by pouring a spore suspension into holes in the soil at their bases also developed the disease. This parasite causes wilt in plants growing in northern parts of the United States and has not been heretofore considered normally adapted to Florida environments. (Florida Agricultural Experiment Station).

VEGETABLE DISEASES IN NORTHERN OHIO IN 1937

J. D. Wilson

Rainfall has been very heavy in many counties in the northern half of the State since the first of the year. There have been several periods since May 1 when some rain has fallen nearly every day for 7 to 10 days.

Soil moisture contents have been maintained at high levels for similar periods, with floods numerous and widespread. These conditions and the exceptionally high air humidities accompanying them have been very favorable for the development of numerous vegetable diseases.

Those which have been especially severe include late blight of celery (Septoria apii), septoria leaf spot of tomato (S. lycopersici), and anthracnose of cucumber and muskmelon (Colletotrichum lagenarium). Late blight of celery appeared early this year, even in many of the seed beds, and has been very difficult to control under the prevailing conditions of consistently high air and soil moisture. Only the most conscientious spray practices have served to keep it in check. Alternaria blight of ginseng (A. panax) was especially severe, with many plantings suffering complete defoliation by August 1st.

Other diseases which have caused severe losses in some instances are, - angular leaf-spot of cucumbers (Bacterium lachrymans), early blight of celery (Cercospora apii), early blight of tomato (Alternaria solani), cercospora leaf-spot of carrot (C. apii carotae), onion scald, and heart-rot of celery.

Several bean diseases have been observed or reported but none has carried much loss as yet. Cercospora leaf spot of beet (C. beticola) and macrosporium leaf-blight of carrot (M. carotae) have been present, but were seldom of much consequence. This is true also for most of the cruciferous diseases. The fusarium diseases of cabbage, tomatoes, celery, etc., have caused a minimum loss this year over most of northern Ohio, possibly because of the cool, moist weather mentioned above. Bottom rot of lettuce (Corticium vagum) has been severe in isolated fields. Pea diseases were generally of little consequence, with some root-rot (Fusarium martii pisi) and septoria blight (S. pisi) reported. Anthracnose of pepper (Colletotrichum nigrum) has also been observed in several instances. (Ohio Agricultural Experiment Station).

DOWNY MILDEW AND BLAST OF ONION IN MASSACHUSETTS AND NEW YORK

MASSACHUSETTS: Onion downy mildew (Peronospora destructor), which appeared in set fields around June 15, continued to spread rather rapidly during the remainder of the month. It was first observed in seed-onion fields July 3, in Hadley.

The unusually hot, dry period of July 6-10, inclusive, checked onion and potato downy mildews temporarily, but both diseases have shown slight further spread during the comparatively dry weather since the tenth. "Blast",

or tip-burn, or "scorch" of onions which began to appear late in June, has developed very rapidly and extensively since the onset of the hot period early in July. The combined effects of blast and downy mildew caused set onions to die prematurely with an estimated reduction in yield of around 25 percent. The two diseases were about equal in their damage. Seed onions, on the other hand, have suffered more extensively, most of the fields throughout the Connecticut Valley now being dead. However, thrips have contributed appreciably to the premature death of the seeded fields. There certainly appears to be no more than 50 percent of a normal yield, and the reduction might be assigned as follows: To downy mildew 10 percent, thrips 10 percent, and "blast" 30 percent. (O. C. Boyd, Massachusetts Agricultural Experiment Station).

NEW YORK: Onions have gone down in many parts of the State. Harvest has begun and from early reports yields apparently are going to run not much over half of those of last year. The consoling thing about it is that the situation is similar throughout the northeastern states with respect to losses and low yields.

The question is often asked about the effect of the mildew on keeping quality. Buyers often argue that a blighted crop will not keep well but the experience of most growers is that if the necks are not too large and are permitted to dry thoroughly there will be little loss. It is only when blight hits suddenly and prevents proper maturing of the necks that poor keeping results.

Recent experiments have confirmed the theory that Peronospora is wind borne by showing that many viable spores reach heights of more than 1,000 feet. This points to the importance of eradicating infested back yard plantings of perennial top set or winter onions which commonly give off spores in May and early June. Surveys have shown that there must be hundreds of such plantings in each county, over twenty having been found in about one-fourth of the gardens of one small town. (A. G. Newhall, Dept. of Plant Pathology, Ithaca, Aug. 13, 1937).

MISCELLANEOUS NOTES ON VEGETABLE DISEASES IN MASSACHUSETTS

O. C. Boyd

Potato late blight (Phytophthora infestans), previously reported from Bristol County on June 17, was observed by a North Hadley grower on June 29. This is another record for early development of the disease, this time in the Connecticut Valley where the disease ordinarily does not appear until late July or during August.

Magnesium deficiency was observed July 9, causing severe injury to potatoes in an extensive planting in Westfield.

Cabbage downy mildew (Peronospora parasitica) was observed in unusual abundance in Bristol County on July 1, both on outer leaves and head. This is usually a fall disease.

A severe case of eggplant wilt (Verticillium sp.) was observed in Agawam on June 30. Some of the plants had made only slight growth since they were set out and showed pronounced internal discoloration. Most of the remainder of the plants showed varying degrees of wilt symptoms. It is believed that at least a greater part of the infection occurred in the seed bed. Early blight (Alternaria solani) of eggplant is more damaging than in the average season.

On summer squash scab (Cladosporium cucumerinum) is common in most fields and is destructive to both foliage and fruit in a few, and mosaic is causing an unusual amount of damage in various parts of the State.

A number of diseases have continued to develop extensively during July, including leaf spots of carrot (Cercospora apii carotae and Macrosporium carotae), celery early and late blights (Cercospora apii and Septoria spp.), bacterial wilt of the cucurbits (Bacillus tracheiphilus), and the bacterial blights of bean. Leaf spot of parsnip (Cercospora pastinacae) was also observed during July, in Montague.

REPORTS ON FRUIT DISEASES

APPLE SCAB (VENTURIA INAEQUALIS) IN MASSACHUSETTS: This has been a difficult year for apple growers to prevent scab infections. There occurred nine infection periods from the pre-pink bud stage to the middle of June, the duration of ascospore discharge. There were additional ones during the remainder of June. The blossom period varied from 10 to 16 days in length, and was cool and rainy generally. Most orchards, other than those that were sprayed or dusted during bloom, contracted scab during the latter part of the blossom period. A majority of the commercial growers found it necessary to use lime-sulfur in one or more of the cover sprays to burn out foliage spots.

Generally, fruit infection is light compared with the amount of leaf infection that has been present. Most instances of pronounced fruit, pedicel, and sepal infections were accounted for by the absence of or lack of thoroughness in the pre-pink spray, allowing infection during the rain of May 6-7; or by the failure to kill out foliage spots promptly during the second and third weeks of June. In most instances where the pink spray was applied thoroughly, the slow-growing fruits remained protected during the unusually long, wet blossom period, whereas the duration of protection of leaves was only about 6 to 8 days.

APPLE SCAB IN NEW YORK: In Monroe County scab has been kept off the fruit in many orchards where there is some leaf infection (R. S. Granger, Aug. 9). Scab is responsible for more loss in Clinton County than other causes combined, being more serious than during any year since 1928 (A. B. Burrell, Aug. 9). In Orange County apple scab is still alive and in some orchards it is spreading slowly in the more susceptible varieties. There was rain most of August 10 and 11, and in some orchards this may result in late infection (R. W. Tousey, Aug. 16). In Niagara County scab is going to take a heavy toll in orchards not thoroughly covered. The tops of most orchards show too much scab (J. C. Goodrich, Aug. 16). In Wayne County live spots of apple scab are sufficiently numerous in most blocks so that there is danger of late spread in case of infection rains (M. E. Buckman, Aug. 16).

STRAWBERRY DWARF IN MASSACHUSETTS: The most pronounced case of strawberry dwarf I have ever seen during the picking season was observed in Dighton on June 24 in a field of Howard 17 variety. The mother bed while in the late blossom stage on May 21, 1936, showed only a few diseased plants. This year, from one-third to one-half of the plants showed degrees of injury varying from very light to heavy crimping and stunting with blasted blossoms and "nubbin" berries. Specimen plants were submitted to Dr. J. R. Christie who reported Aphelenchoides fragariae present in all and abundant in some. The leaves that had developed more recently, during June for example, on most of the diseased plants were heavily flecked or stippled with brown specks. The cause of this condition is not definitely known.

An examination of strawberry beds in Falmouth on July 1 revealed no symptoms of the disease in leaves or runners that had developed since May. This is the usual behavior of dwarf on Cape Cod, and it was a surprise to see such late-season occurrence of the same disease in nearby Bristol County. (O. C. Boyd, July 6).

DOWNY MILDEW AND OTHER DISEASES OF TOBACCO IN MASSACHUSETTS

O. C. Boyd

Following the observation of tobacco downy mildew (Peronospora tabacina) on shade tobacco in Westfield on June 30, where it has been developing in the field since field setting, it was observed on July 9 in several fields of Havana seed tobacco in Southwick and in one additional field in Westfield. On July 16, a rather extensive infection was observed in a tent in Agawam, another town in the southern part of the State. However, no further development appeared to have occurred since the hot, dry spell of July

6-10, and no sporulation could be found on either July 9 or 16. Surveys further up the Valley failed to reveal infections in either Havana or shade tobacco in the extensive districts of Hadley, Hatfield, and Whately. The growers there had not seen anything unusual in either their beds or the fields, whereas in Southwick most of the growers questioned were familiar with its appearance in either the bed or the field or both.

Other tobacco diseases observed during July include mosaic (virus), common and severe as usual; brown root (non-parasitic) in Hadley; wildfire (Bacterium tabacum) as traces or very light infections in several fields of Havana seed. (Massachusetts Agricultural Experiment Station).

BACTERIAL DISEASES OF TOBACCO IN CANADA

L. H. Koch

(From The Lighter, mimeographed publication issued by the Tobacco Service of the Department of Agriculture, Canada. Vol. 7, no. 3, pp. 13-16 Ottawa, July, 1937).

In Canada tobacco is subject to several important bacterial diseases. ****

Angular leaf spot (Bacterium angulatum, Fromme & Murray): In both Ontario and Quebec angular leaf spot occurs every year to some extent, but is more destructive in some seasons than in others. ****

This disease is severe more frequently in Quebec than in Ontario. During 1935 angular leaf spot appeared in epiphytotic proportions in the L'Assomption district in Quebec. Striking differences were observed in the amount of infection on different varieties growing close to each other. Of the varieties, chiefly pipe, which are grown in this district, Parfum d'Italie was most severely infected. Petite Havane was also extremely susceptible. According to Mr. Turcotte of the L'Assomption district both Parfum d'Italie and Petite Havane are particularly susceptible to physical injury. This would account, at least in part, for their susceptibility to angular leaf spot. Considerable infection also appeared in some cases on Large Connecticut Havana (Grand Rouge) while, on the other hand, little infection appeared on the variety Belge which is resistant to physical injury.

Wind and rainfall play major roles in the dissemination of the bacteria causing angular leaf spot. This was strikingly demonstrated in 1935 in Quebec. A survey of the Farnham tobacco district only 60 miles distant from L'Assomption showed the occurrence of relatively little disease in that area. An analysis and comparison of the meteorological data from these two districts revealed a probable explanation of the differences in the amount

of disease. During July the rainfall at L'Assomption was unusually heavy, namely, 7.28 inches, while at Farnham it was only 3.03 inches. Also, during August the rainfall at L'Assomption amounted to 3.97 inches while at Farnham it was only 2.21 inches. For long periods on seven occasions during the critical months of July and August, the relative humidity at L'Assomption remained much higher than at Farnham. Consequently the higher incidence of angular leaf spot infection at L'Assomption was readily explainable on the basis of higher relative humidity and greater rainfall than at Farnham. ****

Wildfire (Bacterium tabacum, Wolf & Foster): Wildfire of tobacco has been sporadic in Canada, where the earliest report appears to have come from the Yamaska Valley in Quebec in 1925. Since that date it has been reported at various times in this district, in the tobacco district north of Montreal and in Ottawa. The disease may at certain times have also been present in the tobacco-growing districts of Ontario along the north shore of Lake Erie, but to date it has not proved serious.

Wildfire is primarily a leaf spot disease, though it also occurs upon the flowers and seed pods. It may appear on the leaves at any time from the seedling to the mature plant stage. Though the earliest stages of the disease have not been observed in Canada, they have been followed closely in different states to the south. ****

Hollow-stalk: Hollow-stalk is a field disease of tobacco which in Canada has been observed to occur sporadically both in Ontario and Quebec since the early days of the industry. To date it has consistently proved to be one of the less serious diseases of tobacco. This disease is usually noticeable only after the tobacco has reached the topping and suckering stage and is usually manifested in the plants by a wilting of the top or bottom leaves after which the latter droop and remain attached to the main stalk. Soon afterwards brown, sunken areas appear in the main stem near the axils of the leaves. The disease is unquestionably favored by wet weather and after it has progressed for some time, often transforms the pith of the entire main stem into a slimy mass which ultimately dries up and leaves the stem hollow and dark brown or black on the inside.

The bacteria (Bacillus aroideae) which cause hollow-stalk are spread from diseased plants to adjacent ones by the hands of workers, mostly during topping and suckering operations. Plants on poorly-drained soil or those with a very succulent type of growth appear to be more subject to the disease than plants growing under more normal conditions. If the disease is present in a field and the plants must be handled, then the diseased ones should be handled last.

Black leg: Black leg is a disease of tobacco seedlings which, as far as can be ascertained, has been investigated and reported only in Kentucky

by Johnson & Valleau in 1931. Wolf in his textbook "Diseases of Tobacco" (1935) reports both hollow-stalk and black leg as caused by the bacterium Bacillus aroideae. This may eventually prove to be correct. As yet, however, the identity of these two diseases has not been demonstrated.

In Canada during 1936 black leg proved to be an important disease of seedlings in both Essex and Kent counties, and was observed by Dr. Berkeley to be also present in Norfolk county. It was first discovered near Chatham and later found widespread throughout both counties. The disease first appeared on seedlings as a brown lesion usually limited to one side of the stem near the ground. In the course of one or two days this lesion usually extended upwards and into the petioles and the leaf tissue. By this time the stem was often girdled, the affected tissues became slimy and soft, and the plant either fell to the ground or leaned entirely on adjacent plants. In the course of a few days affected plants could always be recognized by the lesion at the base of the stem which by this time had turned black in color, and often by the characteristic odor of putrefaction in the affected beds. Both the progress and severity of the disease appeared to be directly dependent upon wet weather or high humidity and severe attacks were in several instances alleviated by the removal of the canvas or glass, thus allowing adequate ventilation accompanied by a thorough drying of the seedlings. It was also observed that severe attacks of this disease occurred only where the seedlings were too crowded.

On some occasions when the seedlings were near the transplanting stage it was found difficult, except by microscopic examination, to distinguish between damage by the ordinary damping-off fungi Rhizoctonia and Pythium, and damage caused by black leg. It is true that sometimes these two troubles were found together, but more often either one or the other disease was causing the trouble and it was usually easy to distinguish black leg by the appearance of the characteristic black lesions and the odor of the affected parts of the bed or the individual plants. Much concerning this disease is unknown and if in Ontario it continues in the future to cause as much damage as in 1936, further, more detailed investigation will be imperative.

In concluding this paper it might be mentioned that information of strictly Canadian origin regarding bacterial diseases of tobacco as yet is necessarily sparse due to the fact that only recently are tobacco diseases being intensively investigated in Canada. It is altogether likely, for instance, that bacterial leaf spots, other than angular leaf spot and wildfire are present in Ontario and Quebec. Mr. Newell's investigation on this subject should advance our knowledge in this regard. It is also not impossible that certain bacterial root troubles are being confused with other diseases.

PROGRESS OF THE CANADIAN TOBACCO CROP - JULY 15, 1937

(Excerpts from The Lighter, Vol. 7, no. 3, pp. 5-9).

ONTARIO: Precipitation to date this year is far above normal in all tobacco districts. **** The very high soil moisture has been particularly favorable for the development of root-rots in Burley and dark tobacco. Consequently root-rots are prevalent this season and no doubt will reduce the Burley and dark crops somewhat. Tobacco mosaic is also particularly prevalent in flue-cured fields where a crop of tobacco was grown in 1936. This disease is very much less prevalent in fields where flue-cured tobacco is alternated with fall rye in a rotation. (H. F. Murwin).

THE NEW BELT OF ONTARIO: Rainfall for the first six months of 1937 at Delhi amounted to 28.49 inches in contrast to 13.91 and 15.92 inches for the similar period of 1936 and 1935, respectively. Recorded rainfall for the first fifteen days of July this year was 3.49 inches, while .09 and 1.31 inches fell during the same time in 1936 and 1935. On low-lying areas tobacco has suffered from excessive moisture. An examination of the roots of plants in such areas usually reveals a very unhealthy condition. Evidence of leaching is quite apparent on high land, especially where the soil is light and where it was not adequately protected by a cover crop during the winter and early spring months. On a number of the knolls the plants are quite stunted and etiolated and often the roots of these stunted plants bear brown lesions.

Some indications of starvation have been noted where the fertilizer was applied a relatively long time before transplanting. Mosaic is very prevalent in fields which produced tobacco last year. Fortunately, the majority of the crop is grown in a two-year rotation and where this is coupled with sanitary practices mosaic is not a serious factor. Black root-rot (Thielaviopsis basicola) and brown root-rot have been observed in a number of fields but, while more abundant than last year, cannot yet be considered of great consequence in this district. (F. A. Stinson).

QUEBEC, NORTHERN DISTRICT: Cigar and pipe tobaccos -- In contrast with last year, black root-rot is scarce this year. This is due to the relatively dry and warm weather that prevailed during the early part of the season.

Mosaic is not very severe in this district. Occasionally a few isolated fields are badly infested, but as a rule the infection is low. The progress made in the preparation and management of tobacco plant beds is no doubt partly responsible for the reduced mosaic infection. No other disease has been reported to date.

Flue-cured tobacco -- The flue tobacco fields, in general, have not been seriously damaged by insects or diseases up to the present time. (Geo. E. Turcotte).

QUEBEC, SOUTHERN DISTRICT: Some trouble was encountered in the district at the seed-bed stage on account of lack of sunshine and high humidity. The damping-off disease did considerable damage.

NOTES ON TOBACCO DISEASES IN ONTARIO, ESSEX AND KENT COUNTIES, 1937

L. H. Koch

(From The Lighter, vol. 7, no. 3, p. 16).

Since it was not possible to conduct a disease survey of the seed-beds in Essex and Kent counties this year, the prevalence of seedbed diseases is not known. However, complaints of damage were again made this year, mostly by growers in Essex County, of the brown root condition of seedlings observed last year for the first time in Essex County. Cases of black leg and black root-rot from Essex and Kent counties were also brought to our attention.

As far as field diseases of tobacco are concerned, both brown and black root rots are particularly prevalent this year, the latter disease being widespread throughout both counties, while brown root rot again appears to be causing most damage in Essex County. The heavy rains of June have especially favored the development of black root-rot, though since the recent warm weather much recovery has been observed. Several instances of severe mosaic infection were observed in the Leamington district and instances of leaf spotting, probably angular leaf spot, were noted as early as June 21 in the vicinity of Harrow.

LEAF BLISTER OR CURL OF OAK

O. P. Owens

Practically all species of oak are attacked by Taphrina coerulescens. This disease is very common and wide spread throughout North Carolina; however, the severity of the infection has not been sufficiently great to cause any serious concern until the last two years. The species of oak most commonly infected in the State are: southern red oak (Quercus rubra), scarlet oak (Q. coccinea), blackjack oak (Q. marilandica), black oak (Q. velutina), live oak (Q. virginiana), white oak (Q. alba), willow oak (Q. phellos), water oak (Q. nigra), swamp chestnut oak (Q. prinus), and post oak (Q. stellata).

Infection is much more severe on southern red oak, scarlet oak, blackjack oak, and black oak. Other species are attacked in varying degrees. The heaviest infection on all species occurs on isolated trees, such as shade

trees on lawns, and on those along the border of woodlands. The disease occurs in all parts of the State but is much more severe in the eastern and southeastern part in the coastal plain area. (North Carolina State College).

DUTCH ELM DISEASE ERADICATION

(Bureau of Entomology and Plant Quarantine weekly reports, July 31 and August 7).

Confirmation has been received covering the first Graphium case in Athens, Ohio. The tree is located on the bank of the Little Hocking River and near the Baltimore and Ohio Railroad. Athens is within the bounds of the southern Ohio Scolytus multistriatus infestation. (Aug. 7).

During the period Dutch elm disease was confirmed in 927 trees, of which 20 were in Connecticut, 758 in New Jersey, 138 in New York, 10 in Indianapolis, Indiana, and 1 in Athens, Ohio.

BRIEF NOTES ON PLANT DISEASES

STEM RUST (PUCCINIA GRAMINIS) IN THE SPRING WHEAT REGION: Loss in the Wheatstone Valley about 70 percent; in southeastern North Dakota about 60 percent. Northward from Fargo and Moorhead and northwestward from Fargo the average is less but local variation is very great. Thirty percent of durum will suffer little damage; about 30 percent certain to be severely injured; and damage to remainder depends on weather. (E. C. Stakman, telegram to Bureau of Entomology and Plant Quarantine, Aug. 5).

BACTERIAL WILT (APLANOBACTER STEWARTI) ON SWEET CORN IN NEW YORK: Counts in the Wantagh area, Nassau County, Long Island, show 50 percent loss from wilt in Golden Cross Bantam in one field. The corn flea beetle is very abundant. (M. C. Richards, Aug. 9).

In Westchester County bacterial wilt caused considerable losses to three growers. Two growers lost 56 acres from this disease. (M. E. Buckley, Aug. 16).

DISEASES OF ORNAMENTALS AND TREES IN MASSACHUSETTS: Elm chlorosis or "mosaic" was observed along the highway in Franklin County, July 2. Among diseases that continued to develop extensively during July were: Peony botrytis blight (Botrytis paeoniae), causing severe damage in some gardens; iris bacterial leaf blight (Bacterium tardicrescens), with a noticeable increase in its distribution in the State, and a tremendous increase in the amount of damage as compared with former seasons. Yet, some varieties appear to escape the disease almost altogether. Iris leaf spot (Didymellina iridis),

heaviest infections I have ever seen for July; hollyhock rust (Puccinia malvacearum); elm leaf spot (Gnomonia ulmea); rose black spot (Diplocarpon rosae), causing severe premature defoliation in many instances. (O. C. Boyd, Massachusetts Agricultural Experiment Station).

JULY WEATHER

The month of July 1937, was characterized by moderate temperatures over the southern and eastern portions of the country, abnormally warm weather in central and northern Midwestern States, and very unevenly distributed rainfall over the principal agricultural sections of the country. Figure 41 shows that the average temperature for the month was near normal throughout the Cotton Belt and in Central and Northern States east of the Mississippi River, the monthly means in these areas ranging mostly from about 1° below normal to 1° or 2° above. On the other hand, over the Great Plains the monthly means ranged generally from 3° to 6° above normal, while moderate plus departures are shown for most western sections of the country, being rather large in the Great Basin and northern Rocky Mountain area.

Figure 42 shows that the general tendency was for moderate dryness to scanty rainfall rather generally east of the Rocky Mountains, though some restricted areas received monthly totals decidedly in excess of normal. Rainfall variations were often in marked contrast in contiguous localities, such as heavy rains in extreme northern Missouri and southern Iowa and very scanty amounts in northern Iowa, southern Minnesota, and some adjoining sections. The Southwest had a decidedly dry month, with less than 25 percent of normal rainfall in parts of Oklahoma and Texas. In the Atlantic States the falls ranged from moderately below normal to somewhat above normal rather generally.

The relatively greatest rainfall occurred from eastern Montana and Wyoming southwestward, where the monthly totals ranged up to four times the normal locally and more than twice the normal over considerable areas. However, to the northwest of this belt there was very little precipitation, totals ranging down to less than half the normal in the interior of the Pacific Northwest. (Weekly Weather and Crop Bulletin for the week ending August 3).

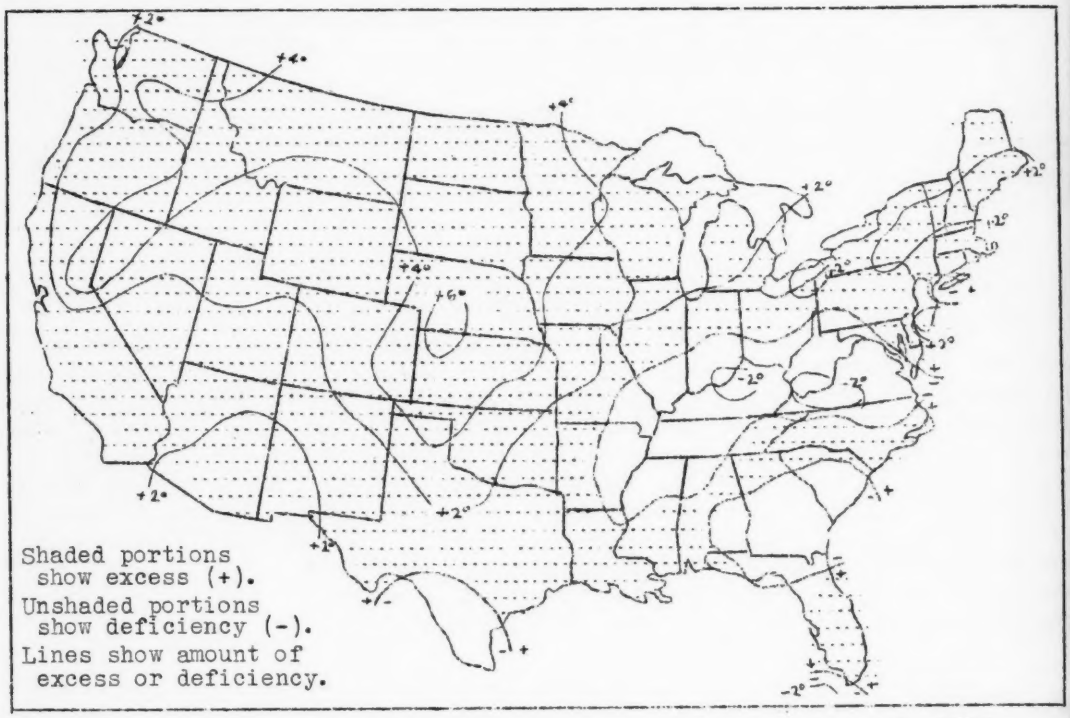

Fig. 41. Departure of Mean Temperature from the Normal for July 1937.

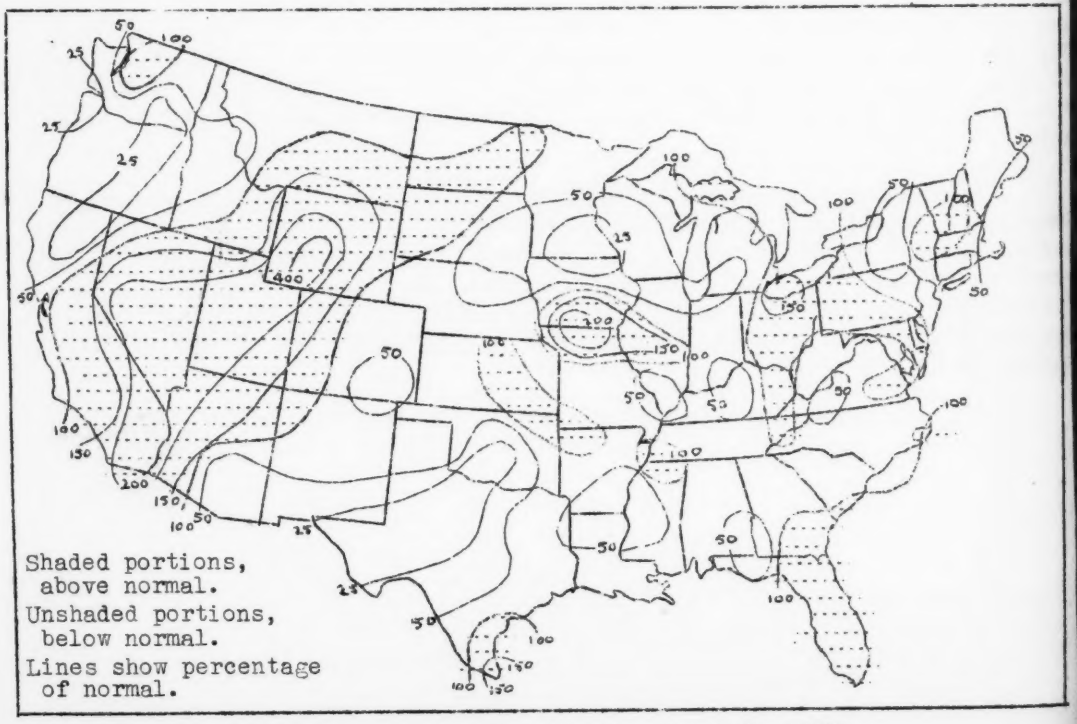

Fig. 42. Percentage of Normal Precipitation for July 1937.